

11/25 What is claimed is:

1. A rotary hammer, which comprises:

an intermediate shaft (24) which is rotatably driven by a motor of the rotary hammer when power is supplied to the motor;
a spindle (18) which can be driven in rotation about its axis by the intermediate shaft 24 by way of a spindle drive arrangement (62,64);

a tool holder (16) arranged for rotation with the spindle (18) for releasably holding a bit or a tool such that the bit or tool can reciprocate;

a pneumatic hammering arrangement (20,21,22) located within the spindle (18) which can repeatedly impact the bit or tool held within the tool holder (16);

said pneumatic hammering arrangement comprising a piston (20) which can be reciprocally driven by a hammer drive arrangement (34,36,38,39,40,42) which can translate rotary drive from the intermediate shaft (24) to a reciprocating drive to the piston (20); and

a mode change mechanism for changing the operation of the rotary hammer to operate in any of three modes, a rotary drive only mode, a hammer only mode or a rotary hammer mode;

said mode change mechanism comprising:

a single actuator (8) switchable by a user of the rotary hammer amongst the three modes of operation;

a spindle driving member (56) rotatable on the intermediate shaft (24) for driving the spindle drive arrangement (62,64);

a hammer driving sleeve (34) rotatable on the intermediate shaft (24) for driving the hammer drive arrangement (34,36,38,39,40,42); and

a mode change sleeve (52) which is permanently driven by and shiftable along the intermediate shaft 24;

where, upon the switching of the actuator (8) by a user, shifts the mode change sleeve (52) along the intermediate shaft (24) amongst the three modes positions, such that in a first rotary drive only position the mode change sleeve (52) transmits rotary drive to the spindle driving member (56) to transmit rotary drive to the spindle drive arrangement (62,64), in a second hammer only position the mode change sleeve (52) transmits rotary drive to the hammer driving sleeve (34) to transmit rotary drive to the hammer drive arrangement (34,36,38,39,40,42), and in a third rotary hammer position the mode change sleeve (52) transmits rotary drive to the spindle driving member (56) and to the hammer driving sleeve (34) to transmit rotary drive to the spindle drive arrangement (62,64) and to the hammer drive arrangement (34,36,38,39,40,42).

2. The rotary hammer according to claim 1, which further comprises:

- a driven member (54) on the mode change sleeve (52);
- a driving member (50) mounted non-rotatably on the intermediate shaft (24) in permanent engagement with the driven member (54), so that rotation of the intermediate shaft rotatably drives the mode change sleeve.

3. The rotary hammer according to claim 1, which further comprises:

- a driving member (54) on the mode change sleeve (52);
- a driven member (48) on the hammer drive sleeve (34); and

wherein the hammer drive sleeve (34) is located towards the rear of the mode change sleeve (52) and the driven member (48) is engageable with the drive member (54) to transmit rotary drive from the intermediate shaft (24) to the hammer drive sleeve (34).

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4. The rotary hammer according to claim 3, wherein the driven member (54) which engages the driving member (50) is axially extended to form the driving member (54) of the mode change sleeve (52) which is engageable with the driven member (48) on the hammer drive sleeve (34).

5. The rotary hammer according to claim 1, which further comprises:

a driven member (58) on the spindle drive member (56);
a driving member (54) on the mode change sleeve (52); and
wherein the spindle drive member (56) is located towards the front of the mode change sleeve (52) and the driven member (58) is engageable with the driving member (54) to transmit rotary drive from the intermediate shaft (24) to the spindle drive member (56).

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6. The rotary hammer according to claim 5, wherein the driven member (54) of the mode change sleeve (52) which engages the driving member (50) of the intermediate shaft (24) is axially extended to form the driving member (54) which is engageable with the driven member (58) on the spindle drive sleeve (56).

7. The rotary hammer according to claim 1, which further comprises:

- a driven member (48) on the hammer drive sleeve (34);
- a driving member (54) on the mode change sleeve (52);
- a driven member (58) on the spindle drive member (56);

the hammer drive sleeve (34) is located towards the rear of the mode change sleeve (52) and the driven member is engageable with the driving member (54) to transmit rotary drive from the intermediate shaft (24) to the hammer drive sleeve (34);

the spindle drive member (56) is located towards the front of the mode change sleeve (52) and the driven member (58) is engageable with the driving member (54) to transmit rotary drive from the intermediate shaft (24) to the spindle drive member (56); and

the mode change mechanism is arranged such that in a first rotary drive only position the mode change sleeve (52) is shifted to a forward position on the intermediate shaft (24) to transmit rotary drive to spindle driving member (56) by way of the driving member (54) and the driven member 58, in a second hammer only position the mode change sleeve (52) is shifted to a rearward position on the intermediate shaft (24) to transmit rotary drive to the hammer driving sleeve (34) by way of the driving member (54) and the driven member (48), and in a third rotary hammer position the mode change sleeve (52) is shifted to an intermediate position on the intermediate shaft (24) between the forward and rearward positions and transmits rotary drive to the spindle driving member (56) by way of the driving member (54) and the driven member (58) and transmits rotary drive to the hammer driving sleeve (34) by way of the driving member (54) and the driven member (48).

8. The rotary hammer according to claim 1, which further comprises:

a mode changing member (68); and
wherein the switching of the single actuator (8) shifts the mode change sleeve (52) by way of the mode change member (68).

9. The rotary hammer according to claim 8, which further comprises:

a housing part (2,4); and
the mode change member (68) is mounted on the housing part (2,4) of the rotary hammer so as to be slideable in a direction substantially parallel to the intermediate shaft (24).

10. The rotary hammer according to claim 8, which further comprises:

a mode change arm (72) on the mode change member (68); and
wherein the mode change arm (72) extends laterally of the mode change member (68) with the arm (72) surrounding at least a part of the mode change sleeve (52) and is connected to the mode change sleeve (52) such that shifting of the mode change member (68) shifts the mode change sleeve (52) by way of the mode change arm (72) amongst the three mode positions.

11. The rotary hammer according to claim 1, which further comprises:

a biasing arrangement (76,78) which is located between the actuator 8 and the mode change sleeve (52) in order to bias the mode change sleeve (52) towards the position on the intermediate shaft (24) which corresponds to the position to which the actuator (8) is switched.

12. The rotary hammer according to claim 1, which further comprises:

- a mode change member (68);
- a mode change arm (72) on the mode change member (68);
- a biasing arrangement (76,78), which comprises:
 - a first spring member (76); and
 - a second spring member (78);

wherein the mode change arm (72) extends laterally of the mode change member (68) and at least partly surrounds a part of the mode change sleeve (52) and is connected to the mode change sleeve (52) such that shifting of the mode change member (68) shifts the mode change sleeve (52) by way of the mode change arm (72) amongst its three positions;

the biasing arrangement (76,78) located between the actuator (8) and the mode change sleeve (52) in order to bias the mode change sleeve (52) towards the position on the intermediate shaft (24) which corresponds to the position to which the actuator (8) is switched; and

the first spring member (76) located between a forward end of the mode change sleeve (52) and a forward facing part of the mode change arm (72) and the second spring member (78) located between a rearward end of the mode change sleeve (52) and a rearward facing part of the mode change arm (72).

13. The rotary hammer according to claim 1, which further comprises;

a spindle lock (70) to lock the spindle (18) against rotation when the rotary hammer is in a hammer only mode.

14. The rotary hammer according to claim 13, which further comprises:

a mode change member (68);

the spindle lock (70) comprising:

a first locking member (70); and

a second locking member (62,64); and

wherein the switching of the single actuator (8) shifts the mode change sleeve (52) by way of the mode change member (68) and the first locking member (70) is located on the mode change member (68) and engages the second locking member (62,64) located on the spindle (18) when the mode change member (68) is shifted to a hammer only mode position to lock the spindle (18) against rotation.

15. The rotary hammer according to claim 8, which further comprises:

a housing part (2,4);

a rotatable knob (8) forms the actuator (8) and is mounted on the housing part (2,4);

an eccentric pin (14) on the rotatable knob (8); and

wherein when the rotatable knob (8) is rotated the eccentric pin (14) is rotated and slideably engages with the mode change member (68) in order to shift the mode change member (68) to shift the mode change sleeve (52) amongst its three positions.

16. The rotary hammer according to claim 1, which further comprises:

the pneumatic hammering arrangement comprising:

a ram (21);

a reciprocally driven piston (20) which is reciprocally drives the ram (21) by way of a closed air cushion; and

an anvil (22) which is repeatedly impacted by the ram (21) and, in turn, impacts the bit or tool held in the tool holder (16).

17. The rotary hammer according to claim 1, wherein the intermediate shaft (24) is substantially parallel to the spindle (18).

18. The rotary hammer according to claim 1, wherein:
the spindle drive member (56) comprises:
 a driving member (60);
 a driven member (62), which forms a part of the spindle drive arrangement (62,64); and
wherein the driving member (60) is in permanent engagement with the driven member (62).

19. The rotary hammer according to claim 1, wherein the hammer drive arrangement is a wobble plate arrangement (36,38,39,40).

20. The rotary hammer according to claim 1, which further comprises:

 a releasable detent arrangement (90,92,94) for releasably latching the actuator (8) in a mode switch position.